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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/531,397	03/21/2000	Joseph C. Ballantyne	3797.81466	6866

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EXAMINER

ALI, SYED J

ART UNIT	PAPER NUMBER
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2195

DATE MAILED: 06/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/531,397

Applicant(s)

BALLANTYNE, JOSEPH C.

Examiner

Syed J. Ali

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 25 April 2005.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 34-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 34-48 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>12/9/04; 12/10/04</u> | 6) <input type="checkbox"/> Other: _____  |

PS

### DETAILED ACTION

1. This office action is in response to the amendment filed April 25, 2005. Claims 34-48 are presented for examination.

2. The text of those sections of Title 35, U.S. code not included in this office action can be found in a prior office action.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 34, 39, and 44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

5. Claims 34, 39, and 44 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01.

6. The omitted steps are: the claims recite that the interrupt service routine “minimizes overhead” without any discussion of how the minimization is achieved or what overhead is actually saved. The limitation is a conclusory statement, omitting the necessary detail to determine how or what is minimized.

***Claim Rejections - 35 USC § 101***

7. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

8. **Claims 44-48 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.**

9. The “system” of claim 44 is software per se. The system itself is embodied wholly within software and is not tangibly embodied. Claims 45-48 are non-statutory for at least the same reasons as their parent claim, as they fail to present any limitations that resolve the deficiencies of the claim from which they depend.

***Claim Rejections - 35 USC § 103***

10. **Claims 34-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gee et al. (USPN 6,374,286) (hereinafter Gee).**

11. As per claim 34, Gee teaches the invention as claimed, including a computer-readable medium having computer-executable instructions for performing real-time execution thread switching comprising:

issuing a first non-maskable interrupt from a counter to an interrupt controller when the counter turns over (col. 23 lines 24-29; col. 25 lines 30-33);

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in response to receiving the first non-maskable interrupt, issuing a second non-maskable interrupt from the interrupt controller to a central processing unit (col. 25 lines 37-41);

in an interrupt service routine that services the second non-maskable interrupt,

saving a first execution thread's current state information (col. 25 lines 33-37), wherein the first execution thread is an application-level-code execution thread that does not execute in a most-privileged CPU mode (col. 19 lines 43-44; col. 22 line 64 - col. 23 line 9),

setting the counter to specify when the counter will turn over again (col. 25 lines 41-43),

restoring previously stored state information pertaining to a second execution thread (col. 26 lines 3-7), wherein the second execution thread is an application-level-code execution thread that does not executed in a most-privileged CPU mode (col. 19 lines 43-44; col. 22 line 64 - col. 23 line 9); and

after execution of the interrupt service routine has finished, executing the second execution thread (col. 25 line 66 - col. 26 line 3) such that the interrupt service routine that services the second non-maskable interrupt minimizes overhead associated with switching thread execution from the first thread to the second thread (col. 25 lines 40-47).

12. It is noted that Gee specifically refers to the interrupt controller as an input/output controller (IOC), and uses other terminology that is not explicitly equivalent to the terms used in the claimed invention. However, Gee uses the same methodology of utilizing non-maskable interrupts to perform context switching as claimed. A programmable counter counts clock ticks and/or machine cycles to determine when to issue a non-maskable interrupt signaling the CPU to

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switch from execution of one JVM thread to another. The use of a non-maskable interrupts allows the JVM to execute at a highest priority and prevents it from being preempted before its time slice finishes.

13. As per claim 35, Gee teaches the invention as claimed, including the computer-readable medium of claim 14, wherein the counter is an advanced programmable interrupt controller (col. 10 lines 43-46).

14. As per claim 36, Gee teaches the invention as claimed, including the computer-readable medium of claim 14, wherein the first execution thread's current state information includes stack data, processor data, and floating point-unit data (col. 20 lines 30-57).

15. As per claim 37, Gee teaches the invention as claimed, including the computer-readable medium of claim 14, wherein the previously stored state information pertaining to a second execution thread includes stack data, processor data, and floating point-unit data (col. 20 lines 30-57).

16. As per claim 38, Gee teaches the invention as claimed, including the computer-readable medium of claim 34, wherein the second execution thread is executed after interrupts, which were pending when the interrupt service routine finished, have been executed and after deferred procedure calls, which were pending when the interrupt service routine finished executing, have been executed (col. 23 lines 30-40; col. 23 line 67 - col. 24 line 13).

17. As per claims 39-43, Gee teaches the invention as claimed, including a method for performing the instructions of claims 34-38, respectively (col. 22 lines 52-53).

18. As per claims 44-48, Gee teaches the invention as claimed, including a system for performing the instructions of claims 34-38, respectively (Figs. 1-2).

### ***Response to Arguments***

19. **Applicant's arguments filed April 25, 2005 have been fully considered but they are not persuasive.**

20. Applicant argues that Gee does not *"teach or suggest context switching from a first application-level-code execution thread, which does not execute in a most-privileged CPU mode, directly to a second application-level-code execution thread that does not execute in a most-privileged CPU mode."* As support for this argument, Applicant contends that Gee teaches switching to a privileged thread, as the master JVM of Gee *"has access to the entire memory space and may execute privileged instructions."*

21. It is not disputed that the master JVM, referred to as JVM0 in the reference, is a privileged thread. However, the claims do not require a "direct" context switch from one thread to another. Rather, the independent claims indicate that between execution contexts, an interrupt service routine is called that performs the switch by saving the executing thread's context,

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resetting the timer, and restoring the next thread's context. JVM0 operates as this interrupt service routine (col. 25 lines 30-50, "the JVM0 NMI handler processes the interrupt.")

The threads that are described as the application-level-code execution threads are the JVM threads, which operate as user threads at a less privileged level (col. 19 lines 43-44, "When operating in user mode, the processor executes applications and applets"; col. 22 lines 64-65, "The user thread to be activated is defined by a TCB [thread control block] that has been created by the executive reset method"; col. 23 lines 19-23, "The aforementioned context switch is used to implement multiple JVMs"). The JVMs are treated as user threads that operate at a lower privilege level, where context switching occurs between the various JVMs. JVM0 is actually a handler that services the interrupts.

22. Applicant argues, "*Gee does not, therefore, teach or suggest an interrupt service routine that minimizes overhead associated with switching thread execution from the first thread to the second thread.*" Applicant discusses the operation of JVM0 to support the argument that JVM0 fails to minimize overhead.

23. As discussed briefly above in paragraph 6, the limitation relating to minimizing overhead does not contain the necessary detail to carry much weight. Practically any step, however minimal, of reducing the amount of time for a context switch or making the switch more efficient would meet the limitation of the claim. Gee saves the context of a suspended thread to make resuming execution later easier; this reduces the amount of overhead required when the thread is resumed, so the limitation is met. Should Applicant intend the minimizing of overhead to have a specific method of reducing overhead, the claim should reflect it.



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24. Applicant argues, "*Gee does not teach or suggest that the second execution thread is executed after deferred procedure calls, which were pending when the interrupt service routine finished executing.*"

25. Gee discusses performing "housekeeping operations", including servicing pending interrupts and preparing the application thread for execution. JVM0 cleans up any method calls, interrupts, or other execution contexts, ensuring that the preceding thread has finished its execution before starting the subsequent thread. In this sense, Gee handles all deferred procedure calls before resuming execution of the subsequent JVM thread.

### *Conclusion*

26. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Syed J Ali whose telephone number is (571) 272-3769. The examiner can normally be reached on Mon-Fri 8-5:30, 2nd Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai T An can be reached on (571) 272-3756. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Syed Ali  
June 16, 2005



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